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IN TWO SECTIONS

## Section I

IN THIS ISSUE

Case Study of a Standard Cost System, by William E. Perry ..... 1

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## EDITORIAL DEPARTMENT NOTE

The article published in this issue of the *Bulletin* is a good illustration of why case studies have been found so valuable in N.A.C.A. publications. This is a clear, comprehensive and complete description of a standard cost system developed for a particular company. But in describing this particular standard cost system, the author has presented in a definite and practical way the philosophy of standard costs and the values to be gained from their use. Perhaps no other company will have the same organizational setup or operating method as this company, yet all readers should get from it a clearer understanding of standard costs and possibly some ideas on their practical application to their own companies.

The author of this article, William E. Perry, is a native Pennsylvanian and has never wandered far from his native state. Educated at Dunmore (Pa.) High School, he entered the employ of the Scranton Lace Company in 1919. He continued his education through the Extension Division of the Wharton School of the University of Pennsylvania and graduated in 1923. With the Scranton Lace Company, he advanced to Assistant Treasurer in 1927, and to Controller in 1930. Five years later he was elected a Director of the Company and now serves as a member of its Executive and Finance Committees. Mr. Perry has served as President of the Scranton Chapter and was a member of the National Board from 1933 to 1936. In 1938 he addressed the Chicago Convention on "Tools of Cost Control."

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SEPTEMBER 1, 1940

## CASE STUDY OF A STANDARD COST SYSTEM

By William E. Perry, Controller,
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THERE are a great many different types of standard cost systems in use at the present time, and in order to narrow our field of discussion, I shall describe in some detail one particular cost system which embodies those cost principles which I believe are not only sound in theory, but also capable of practical application. While this system was designed primarily for a full process textile plant, I believe the accounting principles used have a more or less general application.

There are a few fundamental requirements for a successful cost installation: (1) The system should be suitable for the particular industry in which it is to be used; (2) It should cover completely all the detail phases of cost, including standard allowances for labor, material and burden, and standard rates and prices for these factors; (3) The layout of the system should be completely co-ordinated in all details with the manufacturing operations; (4) It should provide for the collection of costs in such a manner that they are charged to the person directly responsible for controlling them; and (5) The system, and the reports arising from it, should be clearly understandable both to the cost accountants who operate it, and to the operating executives who use its reports. Failure to observe these fundamental requirements usually results in the cost accountant and his cost system not attaining their proper place in the management of the corporation.

The cost system which I shall describe in this paper has no generally known name. Perhaps the best designation for it is "The Cost Center—Detailed Operation Type." The system is divided into three parts—the Basic Standards, the Current Standards, and the Current Budget.

### I.—The Basic Standards*

The basic standards are those standards which, once established,

*Authors Note: I have used the term "Basic Standards" in this paper because it seems to be the only adequate description of the fundamentals of this particular cost system. Readers should not confuse its usage here with its more common meaning in connection with that standard cost method based on fixed standards and ratios therefrom.

are used from year to year, and are changed only when a method or procedure is revised.

*Account Classification*

The first basic standard is the organization or classification of the accounts. Some accountants may smile at calling the account classification a basic standard, but I believe it helps impress upon us the necessity of having it so constructed that it is permanent in nature. The general plan of account classification is shown on Exhibit 1. The entire manufacturing plant, including all auxiliary activities, is divided into departments, principally considering the grouping of similar types of work and the area of authority of each of the respective foremen. Each department is then subdivided into cost centers, a cost center usually being a battery of machines or a group of employees assigned to one specific type of work. On our exhibit we have three such cost centers in the yarn preparation department. The next column on the exhibit lists the items of cost which will normally occur in each cost center. The factory ledgers are arranged by departments and cost centers, and there is an individual ledger card for each item of cost in each cost center. The last column of the account classification may be a little unusual, but it is an important part of this particular cost system. Here are listed all of the various jobs or detail manufacturing operations which are performed in each cost center.

*Detail Manufacturing Operations*

At this point we must make a very important decision. On what and how shall we set standards? There are many different viewpoints on this matter, depending on the uses to which the standard costs are put, the type of industry and the theories of the particular accountant. In some instances job costs might be developed, but they are not very well suited to the textile industry for which this system was designed. We might decide that standard costs should be made for every individual product or pattern which is manufactured. I would, of course, agree that this is necessary for any good standard cost system, but I believe such costs should be a by-product of the cost system and not the prime

## Exhibit 1

## ACCOUNT CLASSIFICATION—MANUFACTURING DIVISION

| Department | | Cost Center | | Items of Cost Set up in Cost Center | | | Index of Manufacturing Operations |
|---|---|---|---|---|---|---|---|
| *Acct. No.* | *Name* | *Acct. No.* | *Name* | *Acct. No.* | *Description* | *Optn. No.* | *Description* |
| 501 | Yarn Preparation | 01 | Warping | 172 | Labor —Warping Piece Work | 01 | Prepare 3000 yd. Warp—3600 ends 20/2 Yarn |
| | | | | 150 | Setting up—Time Wk. | 02 | " " " " " " 30/2 " |
| | | | | 210 | Mat'l —Cones & tubes | 03 | " " " " " " 40/2 " |
| | | | | 241 | Sizing | 04 | Prepare 4000 yd. Warp—3000 ends 20/2 " |
| | | | | 255 | Starch | 05 | " " " " " " 30/2 " |
| | | | | 280 | Water | 06 | " " " " " " 40/2 " |
| | | | | 320 | Burden—Handling | | |
| | | | | 365 | Repairs | | |
| | | | | 375 | Supervision | | |
| | | 02 | Winding | 170 | Labor —Winding Piece Work | 01 | Wind 100 lbs. 20/2 Yarn on 3" Spool |
| | | | | 119 | Coning Piece Work | 02 | " " 30/2 " " " |
| | | | | 260 | Mat'l —Tickets & Tape | 03 | " " 40/2 " " " |
| | | | | 306 | Burden—Backwinding | 04 | " " 50/2 " " " |
| | | | | 320 | Handling | 05 | " " 60/2 " " " |
| | | | | 365 | Repairs | | |
| | | | | 375 | Supervision | | |
| | | 03 | Bobbin Preparation | 155 | Labor —Spooling | 01 | Prepare 1 set Bobbins 60/2 Yarn—300 loss |
| | | | | 156 | Stripping & taking out | 02 | " " " 70/2 " " |
| | | | | 160 | Threading | 03 | " " " 80/2 " " |
| | | | | | Mat'l —(None) | 04 | " " " 90/2 " " |
| | | | | 320 | Burden—Handling | | |
| | | | | 365 | Repairs | | |
| | | | | 375 | Supervision | | |

basis on which the standards are originally set. For this industry, and for others with similar problems, I recommend that the basic standards be set on the detail manufacturing operations.

Perhaps a brief discussion of manufacturing operations will give us a common understanding of the term. Take for example the warping cost center in the yarn preparation department which we have on Exhibit 1. The work of this cost center is to prepare the various warps for the looms. There are listed six warps, each made either in a different length or from a different count of yarn. The making of each of these warps is considered as a separate manufacturing operation. In departments following the weaving operation in which the product takes definite form, the detail manufacturing operation may be either folding, hemming, inspecting or mending a single unit of product. In fact, there will be as many detail operations as there are different kinds of hems, folds, mends, etc.

There are a few good reasons for choosing the detail manufacturing operation as the thing on which to build the basic standards. In the first place, it is the unit commonly used by the foremen in measuring their output, and as such makes the accumulation of production statistics on each operation easy. Next, if we set our standards on the individual operations, we can give these standards to the foreman, and he will know exactly what he is allowed for each factor of cost on each operation. This is not only a practical use of these standards, but it also forms the basis of the budgetary control of cost, as will be shown later. Another reason for adopting the detail operations as the basic standards is that the costs on the individual operations can be easily and accurately translated into individual pattern or style costs.

### *The Operation Rate Sheet*

The basic standards for each item or factor of cost on each detail manufacturing operation are recorded on a form, called the Operation Standard Rate Sheet, which is shown in Exhibit 2. This form contains a description of the standard job setup, which is shown on the first few lines. The time and material study men from the cost department set standard allowances for every different type of labor and material required for the operation.

EXHIBIT 2.

OPERATION STANDARD RATE SHEET

WARPING COST CENTER—OPERATION No. 01

Description: Prepare 3000 yd. Warp 3600 ends 20/2 Yarn
Total Weight 250 lbs.

| *Acct. No.* | *Item of Cost* | *Standard Quantity Allowed* | *Standard Price* | *Standard Cost* |
|---|---|---|---|---|
| | *Labor* | | | |
| 172 | Warping Piece Work ..... | 1.0 Hrs. | $1.90 | $1.90 |
| 150 | Setting up—Time Work ..... | 1.3 " | .40 | .52 |
| | *Material* | | | |
| 210 | Cones & tubes—#27..... | 6.0 ea. | .02 | .12 |
| 241 | Sizing—Formula 2 ..... | 50.0 lbs. | .04 | 2.00 |
| 280 | Water ..... | 100.0 gal. | .002 | .20 |
| | *Burden* | | | |
| | Applied on Mach. Hour Basis Time Allowed ..... | 1.4 Hrs. | 2.00 | 2.80 |
| Total | Standard Cost of Operation | | | $7.54 |
| | *Pattern Costing Rate* | | | |
| | Absorbed on Pattern Cost Sheet on basis of number of pounds of Warp Yarn in pattern: $7.54 ÷ 250# = cost per pound | | | $ .03 |

Please note that these are set either in quantities or units of time, and never in dollars and cents. The cost men set the number of machine hours required to run the job through the cost center. In actual practice it is frequently found that a single operation, such as the making of a warp, will be spread over many units of product. Therefore, the cost men also set the basis on which the total cost of a particular operation is to be spread over the individual pattern costs.

The parts of the operation rate sheet described so far are considered as basic standards in that they do not change from one costing period to another. The balance of the operation rate sheet will be discussed later as part of the current standards.

The operation standard costs are used for determining the amount which the actual production should cost at standard each month, and the determination of variations from costs. They also

are used in setting up the monthly budgets for the various departments and cost centers.

*Pattern Cost Sheet*

For perpetual inventory records and for setting selling prices it is necessary to provide standard costs on each individual style or pattern in the entire line of products. The form used for this purpose is shown in Exhibit 3.

EXHIBIT 3.

PATTERN STANDARD COST SHEET

PATTERN NO. 101

| *C. C. No.* | *Raw Mat'l Manuf. Oper'ns* | *Oper'n No.* | *Units in Pattern* | *Stand. Rate* | *Stand. Cost* |
|---|---|---|---|---|---|
| | *Raw Material* | | | | |
| | Warp Yarn 20/2 | | .90 lb. | $ .25 lb. | $.225 |
| | Spool Yarn 30/2 | | 2.00 " | .30 " | .600 |
| | Bobbin Yarn 70/2 | | .10 " | .50 " | .050 |
| | *Operations* | | | | |
| 01 | Warping | 01 | .90 lb. | .03 | .027 |
| 02 | Winding | 02 | 2.00 " | .06 | .120 |
| 03 | Bobbin Prep. | 02 | .10 " | .15 | .015 |
| 04 | Weaving | 17 | 1.20 rks | .20 | .240 |
| 05 | Bleach | 04 | 5.00 yds | .04 | .200 |
| 06 | Dye | 10 | 3.00 pds | .06 | .180 |
| 07 | Hemming | 03 | 6.00 yds | .005 | .030 |
| 08 | Packaging | 12 | 1.00 ea. | .04 | .040 |
| Total Standard Inventory Cost of Pattern | | | | | $1.727 |

The raw material or yarn contained in the pattern is secured by weighing the woven unit of product for the total weight, and then breaking this total down into individual counts of yarn in accordance with established tables.

The other basic costs of a pattern are the various operations through which either the yarn content or the woven unit of product must go in the course of manufacture, which information is furnished by the production planning department. In some instances the full cost of an operation will not apply to one individual unit of product (for example the warp in Exhibit 2 weighs 250 pounds, but only .9 pounds of it is absorbed on the particular pattern

costed in Exhibit 3), and in such cases a common unit must be used in apportioning the operation cost to the individual patterns.

The last two columns of the pattern cost sheet will be discussed under the title current costs.

*Normal or Standard Capacity*

There is one more group of basic standards to consider, that of normal or standard capacities. Rather than delve into how normal capacity should be determined, which really is an extensive discussion in itself, let us take for granted that the matter has been carefully studied and that a normal capacity has been determined for the factory as a whole. It is customary to set this normal capacity in some general production term, usually that used in the principal converting department. In a textile mill this unit is usually either "picks" or "racks" of the weaving department.

In addition to a normal capacity for the key converting department, this cost system also requires that a standard or normal capacity be set for each cost center. In the cost center, machine hours is the generally accepted method of expressing normal capacity, although in some instances employee hours or units of production may do just as well. The normal capacity in each of the cost centers should, of course, be set in direct relation to the general normal capacity of the plant as a whole.

*Resumé of Basic Standards*

Inasmuch as the basic standards described thus far contain the fundamentals of our cost system, it might be well to review them briefly and see what has been accomplished. We note that the factory has been divided into departments according to each foreman's responsibility. The departments, in turn, have been subdivided into cost centers, and in each cost center we have catalogued all the detail operations. All items of cost or operating expense that will occur have been set up in the account classification, and standard allowances for each item have been set on every operation in which such cost may be incurred. Having thus organized the manufacturing costs, we finally provided a means of translating costs incurred into finished product by the use of the

pattern cost sheet. In doing all this we have gone into the last minute details of manufacturing activity and of cost, but I believe this is vitally necessary if we are to have a real cost system.

The first three basic standards organize the infinite details of cost and establish the general principles of accounting to be used. The last basic standards, normal capacities, provide the foundation or starting point of the actual cost work by establishing the level on which the standards shall be set.

## II.—The Current Standard Costs

The term "Current Standard Costs" is used to cover those costs which are set up for use in a specific cost period, say from one physical inventory to another. Under normal conditions the current standards will usually be carried through a fiscal year, being put into effect by pricing the opening inventory with the current standard pattern costs. The current standard costs are built upon the basic costs just covered.

### *Current Production Basis*

The starting point in building a set of current standard costs is, of course, the normal or standard capacity of the plant, or the key converting department, which, in a textile mill is the weaving looms. Suppose the normal capacity were set at 100,000 racks per standard month. This represents revolutions of the looms, but what does it mean in terms of the many and various patterns, with their different raw materials, constructions, colors, etc.? This is the first problem to be solved, and this phase of the work is usually termed the building of the current production basis. Past production records will furnish statistics as to the volume of production on the various patterns, properly grouped by constructions, etc. Adjustments must then be made for dropped patterns, changes in colors, yarns, etc., as well as for the addition of new styles and constructions. The sales division and the production planning department both contribute much helpful information toward making proper adjustments. As a result of this work we should finally arrive at the number of units of each pattern expected at normal capacity level in a standard month. This is set up in the first column of Exhibit 4.

EXHIBIT 4

## BREAKDOWN OF BASIC STANDARD CAPACITY INTO CURRENT PRODUCTION BASIS—BY COST CENTERS

| Current Production Pattern No. | Basis No. Pairs | 01—Warping Oper'n | Pds per Pattern | 100% Pds | 02—Winding Oper'n | Pds per Pattern | 100% Pds | 03—Bobbin Prep. Oper'n | Pds per Pattern | 100% Pds | 04—Weaving Oper'n | Rks per Pattern | 100% Rks | 05—Bleach Oper'n | Yds per Pattern | 100% Yds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | 10,000 | 01 | .90 | 9,000 | 02 | 2.00 | 20,000 | 02 | .10 | 1,000 | 17 | 1.20 | 12,000 | 04 | 5.00 | 50,000 |
| 102 | 5,000 | 06 | .80 | 4,000 | 05 | 1.20 | 6,000 | 04 | .20 | 1,000 | 21 | 2.00 | 10,000 | 09 | 4.50 | 22,500 |
| 103 | 4,000 | 05 | 1.00 | 4,000 | 01 | 1.50 | 6,000 | 03 | .15 | 600 | 01 | 1.50 | 6,000 | 02 | 4.00 | 16,000 |
| 106 | 1,000 | 02 | .70 | 700 | 04 | 1.40 | 1,400 | 01 | .30 | 300 | 04 | 1.30 | 1,300 | 06 | 5.00 | 5,000 |
| 107 | 8,000 | 01 | 1.00 | 8,000 | 03 | 1.00 | 8,000 | 01 | .10 | 800 | 02 | 1.00 | 8,000 | 01 | 4.50 | 36,000 |
| 108 | 2,000 | 01 | 1.10 | 2,200 | 01 | .90 | 1,800 | 04 | .20 | 400 | 09 | 1.10 | 2,200 | 04 | 4.00 | 8,000 |
| 110 | 6,000 | 03 | .80 | 4,800 | 01 | 1.20 | 7,200 | 03 | .20 | 1,200 | 07 | 2.00 | 12,000 | 02 | 5.00 | 30,000 |
| 112 | 4,000 | 04 | .90 | 3,600 | 05 | 1.10 | 4,400 | 02 | .15 | 600 | 02 | 1.50 | 6,000 | 06 | 4.00 | 16,000 |
| 114 | 5,000 | 02 | .90 | 4,500 | 04 | 1.10 | 5,500 | 02 | .10 | 500 | 08 | 1.30 | 6,500 | 05 | 4.00 | 20,000 |
| 115 | 9,000 | 03 | .70 | 6,300 | 02 | .90 | 8,100 | 03 | .20 | 1,800 | 06 | 1.00 | 9,000 | 05 | 5.00 | 45,000 |
| 116 | 6,000 | 06 | .80 | 4,800 | 02 | 1.00 | 6,000 | 01 | .10 | 600 | 11 | 2.00 | 12,000 | 05 | 4.50 | 27,000 |
| | 60,000 | | | 51,900 | | | 74,400 | | | 8,800 | | | 85,000 | | | 275,500 |

### WARPING RECAP BY OPERATIONS

| Oper'n No. | Pds per Oper'n | Pds per Warp | No. of Warps |
|---|---|---|---|
| 01 | 19,200 | 250 | 74 |
| 02 | 5,200 | 250 | 21 |
| 03 | 11,100 | 240 | 46 |
| 04 | 3,600 | 200 | 18 |
| 05 | 4,000 | 400 | 10 |
| 06 | 8,800 | 350 | 25 |
| Total | 51,900 | | 194 |

In the remaining columns of Exhibit 4 there has been worked out the volume for each mill cost center which is required to turn out this normal capacity. Inasmuch as we wish to express the volume of work in each cost center as the number of times each operation must be performed, we use our individual pattern cost sheets, and list under each cost center the operation number and units per each pattern. By multiplying the units per one pair on each pattern by the total pairs expected on the pattern in a standard month, we secure the total units required. Now, if we recap the total pounds required by operations (as shown in the example at the bottom of Exhibit 4) and divide by the number of pounds per individual warp, we finally secure the number of times each of the operations must be performed at normal capacity level. As a result of this work, we know the volume of work that can be expected in each cost center and on each operation for the ensuing period.

*Current Standard Costs*

Now we shall start the rather complicated problem of determining what it will cost to manufacture this normal capacity production in the new cost period. As we approach the problem we should definitely fix in our minds that we shall build these current costs so that they shall be available in three ways: (1) the current standard cost of each detail manufacturing operation; (2) the current standard cost of each individual pattern; and (3) the amount of each item of cost and the total cost for each cost center for a standard month. The procedure is somewhat involved, for the three sets of costs are built almost simultaneously, using the operation rate sheets, pattern cost sheets and current production basis.

*Cost Center Work Sheets*

Exhibit 5 on the opposite page illustrates the procedure for the warping cost center, which is typical of all the others. Here again all of the figures will be developed for a standard month, as this basis will make for ease in handling work when the system begins to function. In the first column the cost clerks list out every item of labor, material and burden cost that will occur in this cost

EXHIBIT 5

## STANDARD COST OF OPERATION AND BUDGET STANDARDS

### COST CENTER: WARPING

| Acct. No. | Item of Cost Name | Standard Cost @ 100% Capacity Oper'n No. | Prod'n | Stand. Rate | Total Cost | Budget Standards | Expected Cost at Various Levels of Operation 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 172 | Warping—Piece Wk. | 01 | 74 | $1.90 | $ | Use standard set on operation rate sheet | | | | | | | | |
| | | 02 | 21 | 2.00 | | | | | | | | | | |
| | | 03 | 46 | 2.10 | | | | | | | | | | |
| | | 04 | 18 | 3.00 | | | | | | | | | | |
| | | 05 | 10 | 3.50 | | | | | | | | | | |
| | | 06 | 25 | 4.00 | 468 | | 421 | 374 | 328 | 280 | 234 | 187 | 140 | 94 |
| 210 | Cones & tubes | 01 | 74 | .12 | | Use standard set on operation rate sheet | | | | | | | | |
| | | 02 | 21 | .10 | | | | | | | | | | |
| | | 03 | 46 | .12 | | | | | | | | | | |
| | | 04 | 18 | .08 | | | | | | | | | | |
| | | 05 | 10 | .20 | | | | | | | | | | |
| | | 06 | 25 | .24 | 26 | | 23 | 21 | 18 | 16 | 13 | 10 | 8 | 5 |
| 241 | Sizing | 01 | 74 | 2.00 | | Use standard set on operation rate sheet | | | | | | | | |
| | | 02 | 21 | 1.90 | | | | | | | | | | |
| | | 03 | 46 | 2.50 | 303 | | 273 | 242 | 212 | 182 | 151 | 121 | 91 | 61 |
| 320 | Handling | | | | 100 | Allow full amount at all levels | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 365 | Repairs | | | | 40 | Allow full amount at all levels | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| 375 | Supervision | | | | 250 | Drop asst. foreman below 70% | 250 | 250 | 250 | 160 | 160 | 160 | 160 | 160 |
| 301 | Depreciation | | | | 150 | Allow full amount at all levels | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| 302 | Insurance | | | | 10 | Allow full amount at all levels | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 303 | Taxes | | | | 20 | Allow full amount at all levels | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 304 | Boiler & Power | | | | 40 | Allow actual cost each month | 40 | 40 | 40 | 35 | 35 | 35 | 30 | 30 |
| 305 | Plant & Bldg. | | | | 20 | Allow actual cost each month | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | Total Cost of Operation | | | | $1427 | | 1347 | 1267 | 1188 | 1013 | 933 | 853 | 769 | 690 |
| | *Expected Variation at Various Levels* | | | | | | | | | | | | | |
| | Amount Covered by Standard Costs at Various Levels | | | | | | 1284 | 1142 | 999 | 856 | 714 | 571 | 428 | 285 |
| | Expected Variance (Loss) | | | | | | —63 | —125 | —189 | —157 | —219 | —282 | —341 | —405 |

center according to the account classification. Then, by referring to the operation rate sheets for this cost center, they list after each item of cost the numbers of the operations on which that particular item of cost will be incurred. For example, all six of the operations have warping direct labor, as well as a cones and tubes cost, so all six operation numbers are shown against these items. However, only three of the types of warps made are sized, so only operations 1, 2 and 3 are listed after this item. Opposite each operation number the cost clerks fill in the normal capacity production from Exhibit 4.

*Executive Committee Sets Standard Rates and Prices*

At this point in building the current costs we must digress from our work on this sheet and bring into the picture the executive committee of the company, for we are now ready to make many important decisions which will have a material bearing on the new standard costs. At the first meeting of the executives there is presented for review and consideration the payroll rate manual, which contains every labor rate being paid by the company. Any proposed changes are noted for the cost department. Also presented are detail schedules on all materials used, showing stock on hand or on order, last standard price, last control price, purchasing department forecast price, and suggested new standard price. This data is reviewed and adjusted where necessary to meet the committee's wishes. At the next meeting of the executive committee the cost department presents its new schedules for depreciation, insurance and taxes, showing same in detail for each cost center, and with comparisons for the preceding period. Since this cost system provides that all costs incurred be ultimately accumulated in the productive cost centers, the pro-rating or distribution basis for the service departments is also presented to the executive committee for review and approval. With the decisions of the executive committee in hand we can again take up the building of our current costs.

*Labor and Material Standards*

You will recall that on the operation rate sheets (Exhibit 2) only the quantity allowances for labor and material were estab-

lished when the basic standards were set up. With the current standard rates and prices set, we can now go back to the operation rate sheets and determine the labor and material amounts on each item of cost. These standard rates are brought over to Exhibit 5 and applied to the production on each operation, and by group multiplication the total cost at standard capacity is secured in detail for this cost center.

*Burden Standards*

The foregoing procedure gives us the direct labor and material standard costs on both the operation rate sheets and the departmental or cost center sheets. The burden rates are next in order.

Once again we must call in the operating executive committee. Starting with the first service, or contributory cost center, and working right through the entire plant, this committee reviews all the variable items of burden costs in each cost center. Three such items, handling, repairs, and supervision, are shown on Exhibit 5, but there are usually many others. The executives are provided with historical data on each of these items, and they set the amounts to be included in the new standards.

After this review by the executives is finished, the cost department applies the depreciation, insurance and tax charges from the schedules previously approved by the executive committee, and the direct cost of operating the cost center at standard capacity is complete. However, this cost system provides for the eventual accumulation of all costs against the productive cost centers, so the direct cost of the contributory or service departments must be prorated over these productive cost centers, using the prorating basis previously developed. The cost of operating the cost center at standard capacity is now complete.

Also available at this point is the total burden cost of this cost center, which information is required in order to develop burden rates for the operation rate sheets. By referring back and securing our basic standard capacity machine hours for this cost center, we can divide this figure into the total burden cost and determine the new standard machine hour burden rate. With this rate in hand, we can once more return to our operation rate sheets, work

out the burden cost, and finally complete the standard cost of each of the detail operations.

*Standard Pattern Costs*

We have now completed two of the three ways in which we require our current standard costs, and the third one—the standard cost of each individual style or pattern—is easily worked out since it is only a matter of applying the respective operation costs to the units for each operation as set forth on the pattern cost sheet. If you wish to see just how this works out, you can turn back to Exhibit 2 and trace the $.03 per pound cost on operation No. 1 to the pattern cost in Exhibit 3, where it appears opposite the first operation listed.

## III.—The Current Budget

*Budget Based on Standards*

All of the standards required for the cost system are now set up and ready for use, and if we did not wish to operate a manufacturing budget we could stop our discussion of building standards right now. What has been provided so far gives us a good set of standard costs for inventory and cost of sales pricing, and for determining the variations from standard as they occur. However, if we are to get the most value out of the cost system, we must be prepared not only to determine the manufacturing variations, but to analyze such variations quickly and intelligently for the operating executives. To my mind this is one of the most important functions of the cost department, and one which, if properly performed, gives the cost accountant a real standing in the operating affairs of his company. To accomplish this result we must carry the present setup one step further and build an operating budget.

Before going into details as to the construction of the operating budget, I should like to state that I believe it is a mistake to build the budget independent of the standard costs. At normal capacity operation the standard costs and the operating budget should be one and the same thing, and the budget should simply be the means of setting additional standards at levels of operation other than

normal, but at all times using the standards as a basis. I also believe that the budget must be flexible. No one can foresee many of the changes which are bound to occur in any future period, and therefore the budget must be sufficiently flexible to incorporate properly all changes in wage rates, operating conditions, etc., as they occur. Failure to provide such flexibility may result in failure of the budget as a tool of cost control. The last general thought I have regarding budgets is that they must be made in detail. I do not believe that lump sum budget allowances ever secure results.

*Building the Budget*

The building of manufacturing budget is also shown on Exhibit 5. The executive committee is again called into session to set the budget standards on each item of cost at the various levels of operation. What they are really doing is determining in advance just what economies are to be made if and when volume declines. In actual practice they also provide for increased allowances over standard when volume goes above normal levels, although no examples of this are noted on the exhibit. In setting the budget standards the executive committee follows the standard operation rate sheets whenever possible. For instance, on direct labor piece work operations the operator gets a fixed sum per unit regardless of the operating level. In this case the costs of operation will decline in proportion to the volume. The same rule holds true generally on manufacturing materials applied to the product in the course of processing. However, on semi-variable or semi-fixed items, such as handling labor and supervision, it is impossible to keep the costs in direct relationship with volume. On such items the executive committee establishes a budget standard which they feel is possible of attainment. On the fixed burden items the same amount must be allowed at all levels. The prorated costs will be controlled by the operating budgets of the respective service departments, so that these items will be allowed in the manufacturing cost center budgets at the actual costs incurred each month.

The budget standards so set up have been translated into cost of operation at various levels in the columns shown on the right

hand side of the exhibit. By comparing the total cost at each level with the amount the standard cost will cover at that level, we can determine the expected variations.

All of the standards required for both costs and budgets are now set up and ready for use. With the figures available on the cost of operations at each level in each cost center, we could go further and bring them together for the plant as a whole. By applying selling prices to our current production forecast which was worked out in Exhibit 4, we could secure total expected sales value. With both sales value and cost determined, it is possible to work out profit-graphs or cross-over charts, sales realization standards, standard mix and standard mark-ups. However, rather than discuss these general standards, let us keep to the manufacturing side of our case study, and review the cost and budget system in operation.

## IV.—Operation of the Cost System

Perhaps the most logical way of reviewing the cost and budget system in actual operation is to follow through the normal transactions of an average month, also observing how the cost system is tied in with the general books. The normal monthly transactions and ledger accounts appear in Exhibit 6.

### *Raw Materials and Manufacturing Supplies*

Let us start with the purchase of raw material and manufacturing supplies. Inasmuch as we set standard prices on both these items, we must use these standards in our perpetual inventory account and immediately transfer any price variation to either the "Raw Material Price Variation Account" or the "Manufacturing Material Price Variation Account."

Raw material is requisitioned from the warehouse by the first processing department in accordance with the production tickets or work order requirements. The total charge-outs of raw material for the month are credited to the inventory account and debited to goods in process at standard prices.

There is one more account required to complete the recording of raw material. We have set up on the pattern cost sheets the standard allowances for raw material. At the point in the pro-

EXHIBIT 6

## TYING IN THE STANDARD COSTS WITH THE GENERAL BOOKS

| TRANSACTIONS FOR THE MONTH | | | GENERAL LEDGER ACCOUNTS | | |
|---|---|---|---|---|---|
| | | | *Cost and Expense Control Accts.* | *Standard Cost Inventory Accts.* | *Standard Cost Variation Accts.* |
| *Item* | *Entry No.* | *Amount* | | | |
| MATERIALS | | | Manuf. Cost Control | Raw Material Inventory | Raw Material Price Variation |
| Raw Material Purchases | ( 1) | $50,000 | ( 7) $ 8,000 \| (14) $ 46,000 | ( 1) $50,000 \| ( 2) $ 2,000 | ( 2) $ 2,000 \| |
| Raw Material Price Variation | ( 2) | —2,000 | ( 8) 20,000 | ( 5) 40,000 | |
| Manuf. Mat'ls Purchased | ( 3) | 10,000 | ( 9) 2,000 | | |
| Manuf. Mat'ls Price Variation | ( 4) | — 500 | (10) 5,000 | | |
| Raw Mat'l del'd to Process | ( 5) | 40,000 | (11) 8,000 | Manuf. Material Inventory | Raw Material Usage Variation |
| Raw Mat'l Usage Variation | ( 6) | — 300 | (12) 1,000 | ( 3) 10,000 \| ( 4) 500 | ( 6) 300 \| |
| | | | (13) 2,000 | ( 7) 8,000 | |
| | | | 46,000 \| | | |
| MANUFACTURED COSTS | | | | | |
| Manuf. Mat'ls del'd to Depts. | ( 7) | 8,000 | | | |
| Payroll | ( 8) | 20,000 | Admin. Expense Control | Goods in Process | Manuf. Mat'l Price Variation |
| Repairs, Misc., etc. | ( 9) | 2,000 | (18) 15,000 \| | ( 5) 40,000 \| ( 6) 300 | ( 4) 500 \| |
| From Prepaid & Deferred Accts. | (10) | 5,000 | | (14) 46,000 \| (15) 500 | |
| Depreciation | (11) | 8,000 | | (16) 100 \| (17) 4,600 | |
| Insurance | (12) | 1,000 | | (20) 70,000 | Variations—Labor |
| Taxes | (13) | 2,000 | | | (15) 500 \| |
| Total | (14) | $46,000 | | | |
| Manuf. Cost covered by Stds. | | 41,000 | | | |
| Manuf. Variations—Labor | (15) | — 500 | | | |
| Material | (16) | + 100 | Selling Expense Control | Finished Goods Inventory | Variations—Material |
| Burden | (17) | —4,600 | (19) 18,000 \| | (20) 70,000 \| (21) 60,000 | \| (16) 100 |
| EXPENSES | | | | | |
| Administrative | (18) | 15,000 | | Cost of Goods Sold | Variations—Burden |
| Selling | (19) | 18,000 | | (21) 60,000 \| | (17) 4,600 \| |
| FLOW OF MANUFACTURED GOODS | | | | | |
| Production Finished | (20) | 70,000 | | | |
| Cost of Goods Sold | (21) | 60,000 | | | |

cessing where raw material is converted into the product, we must determine the difference between the actual material used and the standard allowances, and eliminate any variations from goods in process, charging them to the "Raw Material Usage Variation Account."

*Manufacturing Costs*

As goods flow through the various processes, labor, manufacturing supplies and variable burden charges are expended thereon. In addition, there are depreciation, insurance and taxes, and the cost of all service or contributory departments. As these costs are incurred they are recorded by cost centers in detail in the factory ledgers, which in turn are controlled by an account in the general ledger named "Manufacturing Cost Control."

*Production Statistics*

Having recorded the actual costs of operation for the month, we must now determine the amount of production secured for the money spent. As the production tickets move long from cost center to cost center during the month, we must provide a means of accumulating the number of times each of the many manufacturing operations were performed. This is accomplished either by having a "movement stub" cut off the production ticket each time the material changes location, or by having each operator cut off a "payroll stub" as the various operations are performed.

*Manufacturing Variations*

Having recorded all costs in detail by cost centers, as well as the production on each operation by cost centers, there is now available all the information necessary to determine the manufacturing variations. The procedure is shown in Exhibit 7. The actual costs on each item are set up in the first amount column. In the column headed "Standard Cost for Month" the production on each operation is multiplied by the standard cost allowed on the operation rate sheet to secure the total amount covered by the standards for the month. The manufacturing variations are the difference between the actual costs and standard costs.

EXHIBIT 7

DETERMINING THE MANUFACTURING VARIATIONS

| Department | Accounts Cost Center | | Item of Cost | Actual Cost for Month | Standard Cost for Month Oper'n | Units Prod. | Std. Rate | Total | Variations for Month Labor | Material | Burden |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 501 Yarn Preparation | 01 Warping | 172 | Labor—Warping | $ | 01 | 60 | $1.90 | | | | |
| | | | | | 02 | 10 | 2.00 | | | | |
| | | | | | 03 | 40 | 2.10 | | | | |
| | | | | | 04 | 12 | 3.00 | | | | |
| | | | | | 05 | 6 | 3.50 | | | | |
| | | | | 390 | 06 | 20 | 4.00 | 355 | —35 | | |
| | | 150 | —Setting Up | | 01 | 60 | .52 | | | | |
| | | | | | 02 | 10 | .60 | | | | |
| | | | | | 03 | 40 | .65 | | | | |
| | | | | | 04 | 12 | .90 | | | | |
| | | | | | 05 | 5 | .80 | | | | |
| | | | | 82 | 06 | 20 | 1.00 | 98 | +16 | | |
| | | 210 | Mat'l—Cones & tubes | | 01 | 60 | .12 | | | | |
| | | | | | 02 | 10 | .10 | | | | |
| | | | | | 03 | 40 | .12 | | | | |
| | | | | | 04 | 12 | .08 | | | | |
| | | | | | 05 | 5 | .20 | | | | |
| | | 241 | —Sizing | 35 | 06 | 20 | .24 | 28 | | —7 | |
| | | | | | 01 | 60 | 2.00 | | | | |
| | | | | | 02 | 10 | 1.90 | | | | |
| | | | | 270 | 03 | 40 | 2.50 | 239 | | —31 | |
| | | 320 | Burden—Handling | 100 | | | | | | | |
| | | 365 | Repairs | 20 | 01 | 60 | 2.80 | | | | |
| | | 375 | Supervision | 250 | 02 | 10 | 2.70 | | | | |
| | | 301 | Depreciation | 150 | 03 | 40 | 2.60 | | | | |
| | | 302 | Insurance | 10 | 04 | 12 | 2.70 | | | | |
| | | 303 | Taxes | 20 | 05 | 6 | 3.00 | | | | |
| | | 304 | Boiler & Power | 35 | 06 | 20 | 2.40 | 398 | | | —209 |
| | | 305 | Plant & Bldg. | 22 | | | | | | | |
| Totals | Warping | | | $ 1,384 | | | | $ 1,118 | —19 | —38 | —209 |
| | | | Continue with remaining departments and cost centers | | | | | | | | |
| Totals | Manufacturing Division | | | $46,000 | | | | $41,000 | —500 | +100 | —4,600 |

The journal entries used to record the variations and to close the cost control accounts are shown on Exhibit 6. What actually has happened is that the factory has converted the various items of cost into products in various stages of manufacture. Therefore, we must do likewise on the books. The manufacturing cost control account is closed out to goods in process. Since this is actual cost, and we wish to maintain the goods-in-process inventory account at standard cost, we must remove the variations from the process account and transfer them to our labor, material and burden variation accounts. Journal entries Nos. 15, 16 and 17 are used to record these transfers.

*Finished Goods Inventory*

All production statistics developed up to this point were on manufacturing operations, this being the most practical way of controlling the work and recording the flow through the manufacturing departments. However, when the goods are finally finished and are delivered to the warehouse, the pattern or style number is the usual unit of stock control. All production finished in the month is recorded by pattern number, the standard pattern costs previously set up are applied thereto, and the total standard cost value obtained. This total is credited to goods in process, with the corresponding charge to finished goods inventory. If you pause and recall how the standard pattern costs were developed from the operation rate sheets, you will realize that there is no conflict between determining the variations from standards by operations and moving goods to the warehouse by patterns.

## V.—Reports Arising from Cost System

My main consideration in designing this cost system was that it should serve the executives as a really workable tool for controlling costs. While the executives were brought into the picture several times in constructing the cost and budget standards, this work only assures us that the executives understand the basis of the standards and the functioning of the system generally. However, even a good cost system that is understood by the executives does not in itself control costs. The most that can be expected

is that the cost system will organize the infinite number of details of a manufacturing business in such manner that intelligent and understandable reports can be made from it, and that such reports shall clearly point out where the standards are not being met, and where executive attention is required. It is, therefore, important to us to look beyond the organization of the cost system, and to see if the reports arising from it are really valuable tools of executive cost control.

*Executives Handbook*

It is my opinion that cost report work should start by providing the executives with summarized statements on the month's operation, such as the balance sheet, statement of operations, inventory, production, sales and damage statistics, gross profit analysis, and summarized cost figures. These summarized reports are organized into an Executives' Handbook, which is kept by the executives for quick reference. The purpose of these general statements is to provide the executives with a comprehensive picture of current operations. These reports point out in a general way the costs which are out of line and require further investigation. For example, the statement of operations shows the total variations which have occurred in each of the labor, material and burden variance accounts. To find the reasons for these variances one must go into other more detailed reports. I strongly recommend an Executives' Handbook as a good foundation report in cost work.

*Monthly Budget Reports*

The most important detailed reports are the monthly operating budgets. In the general ledger and on the operating statement the labor, material and burden variance accounts show the source of variations. However, to provide adequate control we must break down these variations by cause. There are three principal causes of manufacturing variations: (1) level of operation being lower or higher than standard capacity; (2) changes which management makes in processes, labor rates, etc., after the standards are adopted; and (3) efficiency of foremen in operating their respective cost centers. This cost system has been designed to

EXHIBIT 8

## ANALYSIS OF MANUFACTURING VARIATIONS

### COST CENTER: WARPING

Month .....
Operation Level .....62%....

| ITEMS OF COST | | | | ACTUAL COST | STAND. COST | MANUF. VAR'NS | BUDGET STANDARDS | EXPLANATION | VARIATIONS | | | FOREMAN'S BUDGET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *No.* | *Account* | | | | | | | | *Oper'n Level* | *Management* | *Foreman* | |
| | *Labor* | | | | | | | | | | | |
| 172 | Warping ..... | | | $ 390 | $ 355 | $ —35 | Use Std. on operation rate sheet | 10% wage increase | $ | $—35 | $ | $ 390 |
| 150 | Setting up ..... | | | 82 | 98 | +16 | Use Std. on operation rate sheet | | | | +16 | 98 |
| | *Material* | | | | | | | | | | | |
| 210 | Cones & tubes ..... | | | 35 | 28 | — 7 | Use Std. on operation rate sheet | | | | — 7 | 28 |
| 241 | Sizing ..... | | | 270 | 239 | —31 | Use Std. on operation rate sheet | | | | —31 | 239 |
| | *Burden* | *100% Standard* | | | | | | | | | | |
| | | *Amt.* | *%* | | | | | | | | | |
| 320 | Handling ..... | $100 | 16 | 100 | 64 | —36 | Allow full amount at all levels | | — 36 | | | 100 |
| 365 | Repairs ..... | 40 | 06 | 20 | 24 | + 4 | Allow full amount at all levels | | — 16 | | +20 | 40 |
| 375 | Supervision .... | 250 | 40 | 250 | 158 | —92 | Drop asst. foreman below 70% | Asst. should be dropped at this level | — 2 | | —90 | 160 |
| 301 | Depreciation .... | 150 | 24 | 150 | 96 | —54 | Allow full amount at all levels | | — 54 | | | 150 |
| 302 | Insurance ..... | 10 | 02 | 10 | 8 | — 2 | Allow full amount at all levels | | — 2 | | | 10 |
| 303 | Taxes ..... | 20 | 03 | 20 | 12 | — 8 | Allow full amount at all levels | | — 8 | | | 20 |
| 304 | Boiler & Power.. | 40 | 06 | 35 | 24 | —11 | Allow actual cost each month | | — 11 | | | 35 |
| 305 | Plant & Bldg.... | 20 | 03 | 22 | 12 | —10 | Allow actual cost each month | | — 10 | | | 22 |
| | | $630 | 100 | (607) | (398) | (209) | | | | | | |
| | Total ..... | | | $ 1,384 | $ 1,118 | $—266 | | | $—139 | $—35 | $—92 | $1,292 |

accomplish this analysis of variations by cause, and at the same time provide a monthly budget report for each cost center.

On Exhibit 7 we developed the actual cost, standard cost and manufacturing variations on each item of cost in a typical cost center. All of these figures have been carried over to Exhibit 8 and set up on the left hand side of the statement. The budget standards shown in this exhibit are those which the executive committee set up at the beginning of the year, which were shown on Exhibit 5. As a matter of fact, these budget standards are really allowances, based on the standard costs, for levels of operation below normal. Therefore, if a foreman follows instructions as set in these budget allowances, he cannot be charged with a variance which is due solely to volume. For example, the exhibit shows a variance loss of $36 on handling. The budget standard states that the full $100 is to be allowed at all levels. Consequently, this loss is due to the level of operation and is so charged in our variation analysis column. On the supervision item, however, the budget standards provided that the assistant foreman was to go back on the bench below 70 per cent. Apparently this was not done and caused a variation loss of $92. The foreman is charged with this variation inasmuch as it would not have occurred had he adhered to the budget standard.

The variations charged to management are those which occur due to changes over which the foreman has no control, such as, in this case, a 10 per cent wage increase. It is this column which provides the flexibility necessary to keep the foremen's budgets right up to date, for it absorbs any variations caused by management changes since the standards were set. This column also keeps the executives informed as to the cost of the changes which they have instituted.

After eliminating variations due to volume and management, those which remain are attributable to the foreman. On direct material and labor any variations due to prices or rates have been eliminated so that any variance on these items is due to inefficient usage. Burden variances charged to the foreman are those which result from not following budget standards. The amounts shown in the last column as the foremen's budget for the month are the standard costs, adjusted for variations due to the level of operation and variations caused by management.

The operating executives receive a variation analysis report on each of the cost centers under their control. The foreman is given a monthly budget report showing only his budget allowances, the actual costs and the variations. The operating executives review the budget reports with the foremen each month.

*Variation in Prices of Materials*

The cost system provided for the recording of variations in the purchase price from standard price on all raw and manufacturing materials. Each month this account is supported by a report showing the detail make-up of the variations. It is reviewed by the purchasing agent and his superior officer. Such a report makes the purchasing agent more aware of his responsibilities, and it gives his supervising official a basis on which to judge the efficiency of the purchasing department.

*Report on Raw Material Usage*

An account to record the variations in the quantity of raw material used as against the standard allowances on the pattern cost sheets was also set up. The cost department must provide an auxiliary record to compile from the stores requisitions and the cost sheets an analysis of these variations in detail. Since raw material is usually one of the heaviest factors of cost, it's proper usage is important. Usually the withdrawal and converting of raw materials into product is done by one department. The foreman of this department and his superior officer receive copies of this report.

*Damage Reports*

Material damaged in the course of manufacture is another source of manufacturing loss. I purposely did not set up in these exhibits any account to record damage losses, in view of the many complexities of this problem. However, the quantity of damages can be secured from the production tickets as the goods move to the finished goods warehouse. These damages either can be written off at no value, or given a salvage value, depending on the product. However they are handled, the damage account

loss should be analyzed carefully each month and the report compiled sent to the chief operating executive.

*Miscellaneous Reports*

There are several other miscellaneous reports which are obtained from this cost and budget system, but I believe I have described enough to demonstrate the general character and scope of the report work. Good reports are important tools of executives for intelligent cost control.

*Summary*

In preparing this paper the time alloted had to be considered, with the result that only the essential features of the cost system could be presented in more or less skeleton form. Likewise, the exhibits used are not the forms in actual use, which are considerably more detailed, but rather were prepared to show only the principles involved. However, the system in its complete detail is so co-ordinated with production control, payroll, general accounting and factory management that it can be, and is, economically operated.

This system has been built on the premise of complete analysis and co-ordination of all details of cost. Proper original recording of all details of cost of operation is necessary if satisfactory budgets are to result and analysis of variations be quickly accomplished. A properly co-ordinated cost system so organizes both cost and production details that they can be summarized where total figures are needed or torn down if the details are required. Also, proper co-ordination results in being able to arrange the detail costs by the various items or factors of cost, or by individual operations or by individual patterns, depending on the form desired for the particular task in hand. Generally speaking, I believe that the strongest points in favor of this type of cost system are the careful handling of details and the complete interchangeability of the standard costs.